FOR OFFICIAL USE

Total for Sections B and C

X007/201

NATIONAL QUALIFICATIONS 2006

TUESDAY, 23 MAY
9.00 AM – 11.00 AM

BIOLOGY
INTERMEDIATE 2

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth
Day Month Year

Scottish candidate number

Number of seat

SECTION A (25 marks)

Instructions for completion of Section A are given on page two.

For this section of the examination you must use an HB pencil.

SECTIONS B AND C (75 marks)

1 (a) All questions should be attempted.

(b) It should be noted that in **Section C** questions 1 and 2 each contain a choice.

2 The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, **and must be written clearly and legibly in ink**.

3 Additional space for answers will be found at the end of the book. If further space is required, supplementary sheets may be obtained from the invigilator and should be inserted inside the **front** cover of this book.

4 The numbers of questions must be clearly inserted with any answers written in the additional space.

5 Rough work, if any should be necessary, should be written in this book and then scored through when the fair copy has been written. If further space is required, a supplementary sheet for rough work may be obtained from the invigilator.

6 Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

SCOTTISH QUALIFICATIONS AUTHORITY

Read carefully

1 Check that the answer sheet provided is for **Biology Intermediate 2 (Section A)**.

2 For this section of the examination you must use an **HB pencil** and, where necessary, an eraser.

3 Check that the answer sheet you have been given has **your name**, **date of birth**, **SCN** (Scottish Candidate Number) and **Centre Name** printed on it.

Do not change any of these details.

4 If any of this information is wrong, tell the Invigilator immediately.

5 If this information is correct, **print** your name and seat number in the boxes provided.

6 The answer to each question is **either** A, B, C or D. Decide what your answer is, then, using your pencil, put a horizontal line in the space provided (see sample question below).

7 There is **only one correct** answer to each question.

8 Any rough working should be done on the question paper or the rough working sheet, **not** on your answer sheet.

9 At the end of the exam, put the **answer sheet for Section A inside the front cover of this answer book**.

Sample Question

Which substances are normally excreted in urine?

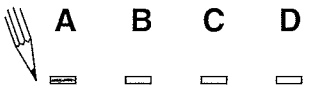
A Urea and salts

B Protein and urea

C Glucose and salts

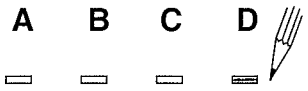
D Protein and salts

The correct answer is **A**—Urea and salts. The answer **A** has been clearly marked in **pencil** with a horizontal line (see below).



Changing an answer

If you decide to change your answer, carefully erase your first answer and using your pencil, fill in the answer you want. The answer below has been changed to **D**.



SECTION A

All questions in this Section should be attempted..

1. Which of the following prevents bursting of plant cells?

A Nucleus

B Cytoplasm

C Cell wall

D Cell membrane

2. Which of the following products is made using bacteria?

A Yoghurt

B Bread

C Beer

D Wine

3. Yeast respire anaerobically when there is a

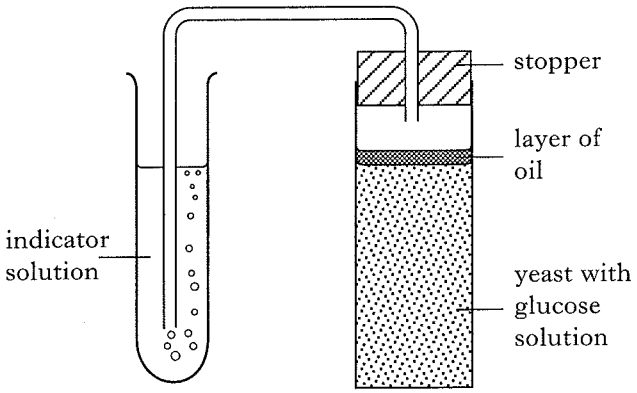
A high concentration of alcohol

B low concentration of oxygen

C high concentration of carbon dioxide

D low concentration of sugar.

4. Respiration in yeast was investigated using the apparatus shown below.



Which of the following changes to the investigation would cause the yeast to respire more slowly?

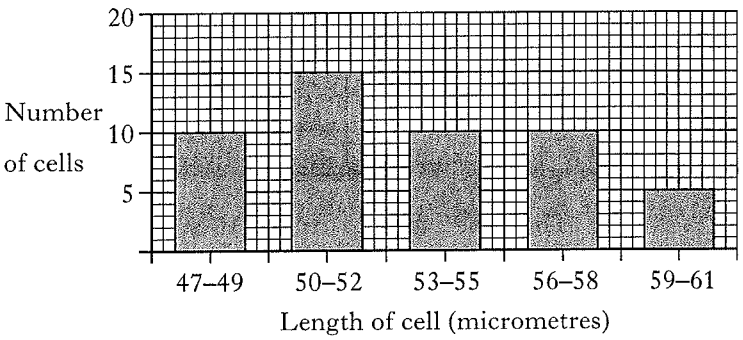
A Use cotton wool instead of a stopper

B Do not add oil to the boiling tube

C Change the indicator solution

D Mix the yeast with water instead of glucose solution

5. The bar chart below shows the number of cells of different lengths in a sample of onion epidermis.



The percentage of cells with a length greater than 55 micrometres is

A 10%

B 15%

C 20%

D 30%.

6. All enzymes are composed of

A carbohydrates

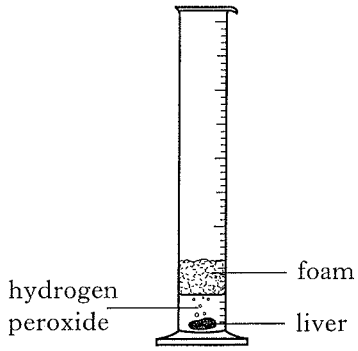
B protein

C glycerol

D fatty acids.

[Turn over

7. Two grams of fresh liver was added to hydrogen peroxide at different pH values.



The time taken to collect 10 cm^3 of oxygen foam was noted for each pH.

pH of hydrogen peroxide solution	*Time to collect 10 cm^3 of oxygen foam* (s)
5	120
7	30
9	50
11	85

At pH 7, the enzyme which breaks down hydrogen peroxide is

A at its optimum activity

B at its minimum activity

C denatured

D digested.

8. The enzyme phosphorylase was added to a 2% glucose-1-phosphate solution. After one hour, the concentration of glucose-1-phosphate had fallen to 0·05%.

How many times lower was the concentration after one hour than at the start?

A 0·1

B 1·95

C 40

D 97·5

9. The table below shows the rate of photosynthesis by a plant measured at different light intensities.

Light intensity (kilolux)	*Rate of photosynthesis* (units)
10	2
20	27
30	51
40	73
50	82

What change in light intensity produces the greatest increase in the rate of photosynthesis?

An increase in light intensity from

A 10 to 20 kilolux

B 20 to 30 kilolux

C 30 to 40 kilolux

D 40 to 50 kilolux.

10. The word equation for photosynthesis is

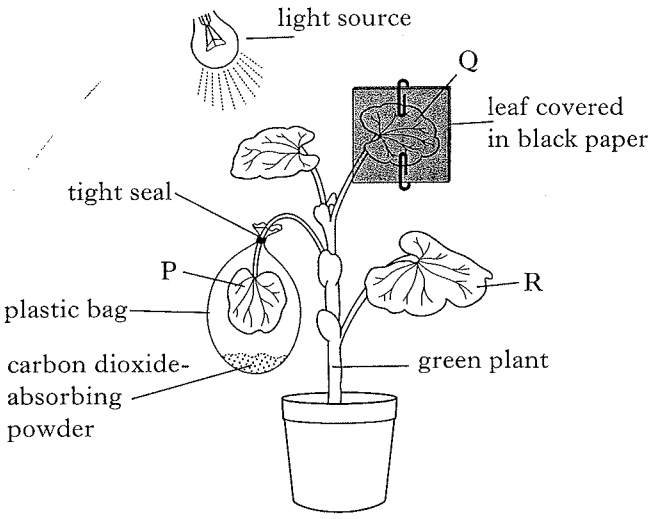
A carbon dioxide + water → glucose + oxygen

B oxygen + water → glucose + carbon dioxide

C glucose + oxygen → carbon dioxide + water

D carbon dioxide + oxygen → glucose + water.

11. The diagram below shows an investigation into photosynthesis.



Which of the following statements is correct?

A P, Q and R make food

B only P and Q make food

C only P makes food

D only R makes food.

12. Plants compete mainly for

A water, light and soil nutrients

B water, food and soil nutrients

C light, water and food

D light, food and soil nutrients.

13. The total variety of all living things on Earth is described as

A an ecosystem

B biodiversity

C a community

D random assortment.

14. In Scotland, many forests are planted with a single species of tree such as Douglas fir.

These forests have

A a stable ecosystem

B complex food webs

C high intensity of grazing

D low insect species diversity.

15. Which of the following sets of conditions are likely to cause woodlice to move about most rapidly?

A Low humidity and low light intensity

B Low humidity and bright light

C High humidity and low light intensity

D High humidity and bright light

16. A piece of potato weighs 20 g fresh and 5 g dry. What is the percentage water content of the potato?

A 5%

B 15%

C 25%

D 75%

17. The table shows water gained and lost by the body over a 24 hour period.

Method of water gain	*Volume of water gained* (cm^3)	*Method of water loss*	*Volume of water lost* (cm^3)
food	800	exhaled breath	300
drink	1000	sweating	
metabolic water	350	urine	1200
		faeces	100

What volume of water is lost by sweating?

A 150 cm^3

B 200 cm^3

C 550 cm^3

D 900 cm^3

18. Marine bony fish have to overcome an osmoregulation problem.

Which line in the table describes how marine bony fish overcome this problem?

	Salts	*Concentration of urine produced*
A	absorbed	concentrated
B	excreted	dilute
C	excreted	concentrated
D	absorbed	dilute

19. Which of the following molecules is absorbed from waste food in the large intestine?

A Glucose

B Water

C Amino acids

D Glycerol

[Turn over

20. Bile is produced in the liver and stored in the gall bladder.

Bile is released into the small intestine where it

A digests fat

B digests glycogen

C emulsifies fat

D emulsifies glycogen.

21. From what substance is urea manufactured and where does this process take place?

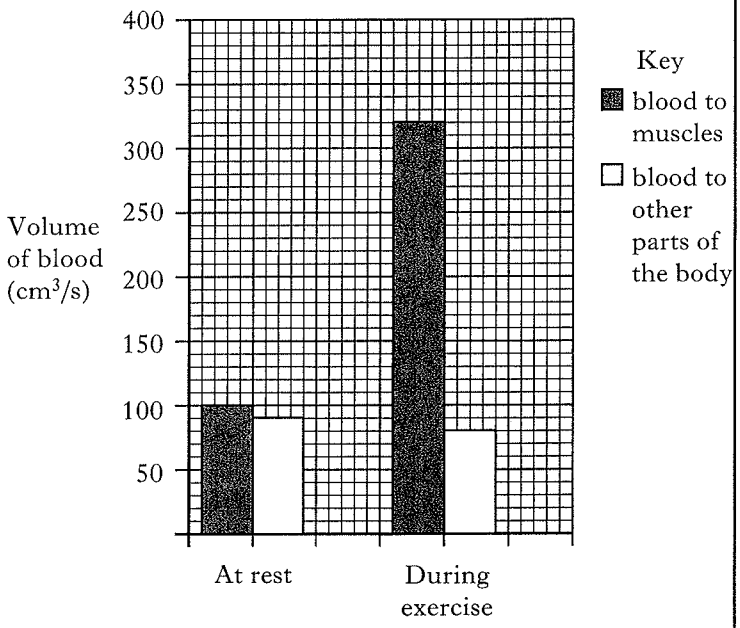
A From amino acids in the liver

B From amino acids in the kidney

C From fats in the kidney

D From fats in the liver

22. The bar chart shows the volume of blood supplied per minute to the skeletal muscles and to other parts of the body of a healthy male at rest and during strenuous exercise.



During **exercise**, the ratio of blood supplied to the muscles to blood supplied to other parts of the body is

A 1 : 4

B 4 : 1

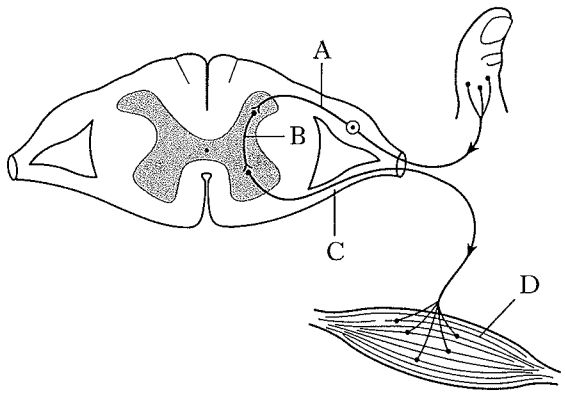
C 10 : 8

D 10 : 9.

23. Which line of the table below identifies correctly the functions of macrophages and lymphocytes?

	Macrophages	*Lymphocytes*
A	produce antibodies	engulf bacteria
B	produce antibodies	produce antibodies
C	engulf bacteria	produce antibodies
D	engulf bacteria	engulf bacteria

24. The diagram below shows the neurones involved in a reflex arc.



Which letter identifies the relay fibre?

25. Which of the following is a response to an increase in body temperature?

A Shivering

B Constriction of blood vessels

C Decrease in sweat production

D Dilation of blood vessels

Candidates are reminded that the answer sheet for Section A MUST be placed INSIDE the front cover of this answer book.

[Turn over for Section B on *Page eight*

DO NOT WRITE IN THIS MARGIN

SECTION B

Marks

All questions in this section should be attempted.
All answers must be written clearly and legibly in ink

1. (*a*) Decide if each of the following statements about the breathing system is **True** or **False**, and tick (✓) the appropriate box.

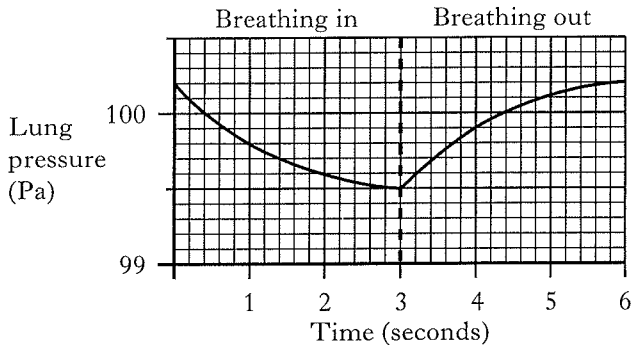
If the statement is false, write the correct word in the **Correction** box to replace the word underlined in the statement.

Statement	*True*	*False*	*Correction*
The trachea divides into two bronchioles.			
Air sacs are moist to allow oxygen to dissolve.			
Large numbers of capillaries surround the air sacs.			

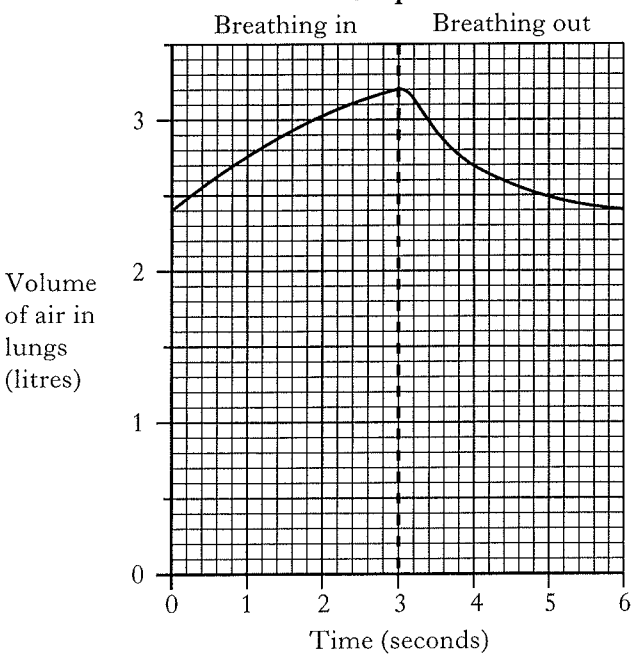
3

(*b*) The following graphs show changes in lung pressure and volume during breathing in and breathing out.

Graph 1



Graph 2



DO NOT WRITE IN THIS MARGIN

Marks

1. (*b*) continued

(i) From graph 2 calculate the volume of air breathed out in one breath.
Space for calculation

Volume = _____ litres **1**

(ii) State the relationship between lung pressure and the volume of the air in the lungs during breathing in.

_____

_____ **1**

(iii) What evidence from graph 2 supports the statement that the lungs are never completely empty of air?

_____

_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

3. (*a*) Amylase is produced in the salivary glands. The substrate of amylase is starch. Amylase was added to a starch suspension and a sugar was produced.

(i) Name the sugar produced by the action of amylase on starch.

_____ **1**

(ii) State the optimum temperature for the action of amylase.

_____ °C **1**

(*b*) An enzyme has a shape which is complementary to its substrate.

(i) What term describes this property of an enzyme?

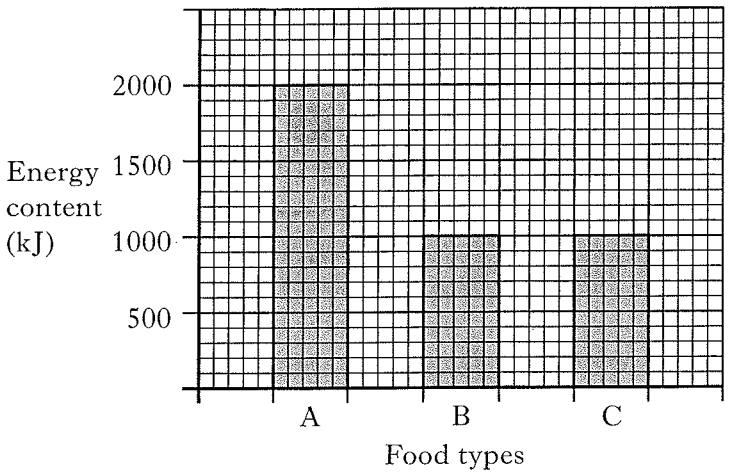
_____ **1**

(ii) Name the part of the enzyme that is complementary to its substrate.

_____ **1**

Marks

4. (*a*) The bar graph below shows the energy content of equal masses of carbohydrate, fat and protein food types.



Identify food type A and give a reason for your answer.

Food type _____

Reason _____ **1**

(*b*) Biuret reagent is used to identify protein.

State the colour of a positive result for this food test.

_____ **1**

(*c*) Name the element found in protein that is not present in carbohydrates and fats.

_____ **1**

(*d*) A healthy human diet contains a variety of minerals. Name one of these minerals and describe how it is used by the body.

Name _____

Description _____

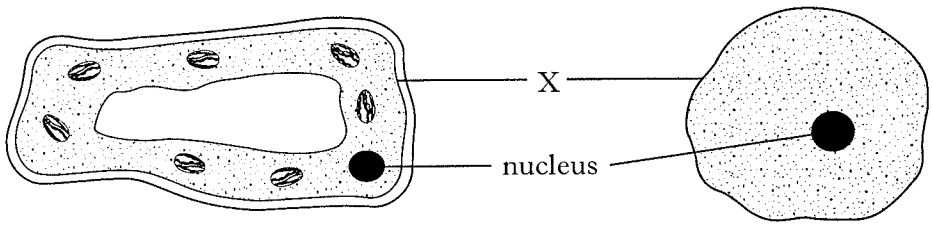
_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

5. (*a*) The diagram below shows a plant cell and an animal cell.



(i) Identify structure X.

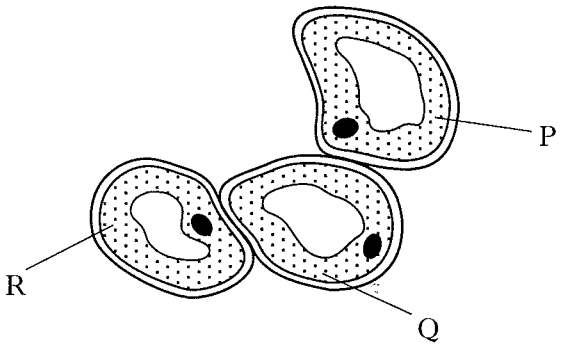
_____ **1**

(ii) Give a function of the nucleus.

_____

_____ **1**

(*b*) Three plant cells P, Q and R are shown below.



(i) Cell P is hypotonic to cell Q and cell R is hypertonic to cell Q.

Which cell has the highest water concentration?

_____ **1**

(ii) If all three cells were placed in pure water for one hour, what term would be used to describe the resulting appearance of the cells?

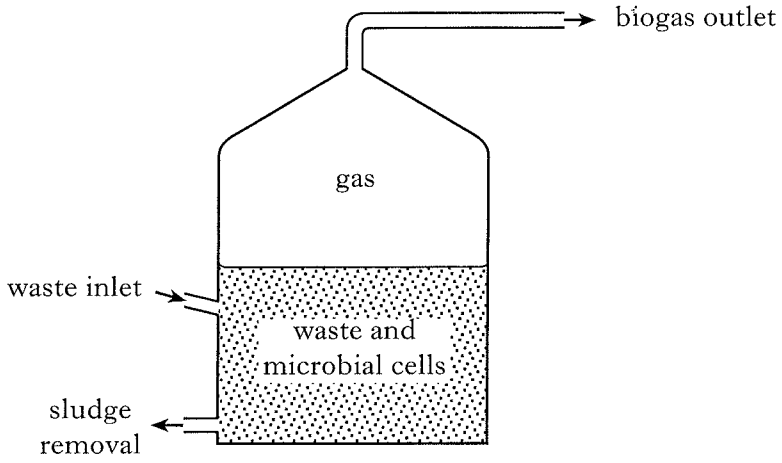
_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

5. (continued)

(*c*) A biogas fuel generator is shown below.



(i) What type of microbial cells produce biogas?

_____ **1**

(ii) Name the main gas collected at the biogas outlet.

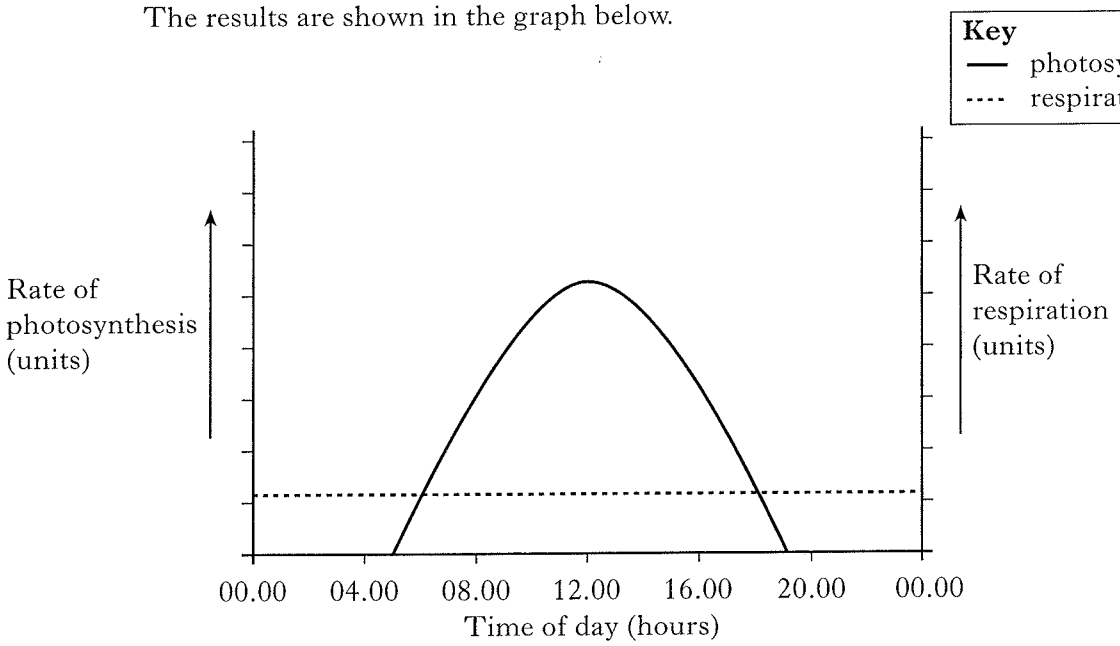
_____ **1**

[Turn over

Marks

6. The rates of photosynthesis and respiration in a green plant were measured over a period of 24 hours.

The results are shown in the graph below.



(*a*) (i) At what time was the production of glucose at its maximum?

_____ **1**

(ii) Between what two times was the plant producing more oxygen than it was using?

Between _____ and _____ hours **1**

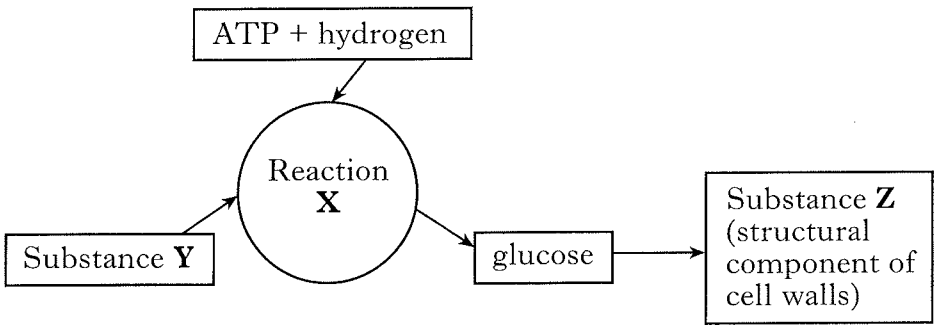
(*b*) What substance traps the light energy required for photosynthesis?

_____ **1**

Marks

6. (continued)

(*c*) The diagram below represents a summary of part of the process of photosynthesis.



Name the following:

Reaction X _____

Substance Y _____

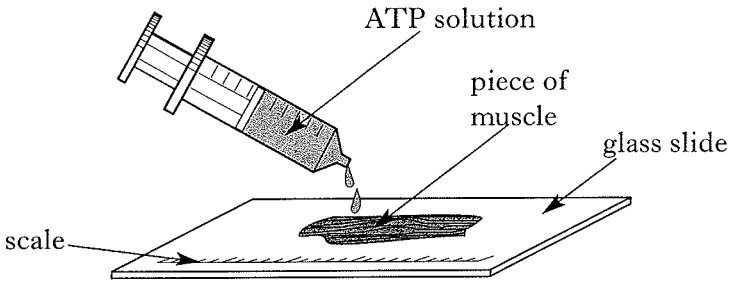
Substance Z _____ **3**

[Turn over

Marks

7. (*a*) The diagram below shows part of an investigation into the effect of adding three different concentrations of ATP solution to three pieces of muscle.

Equal volumes of the ATP solutions were added to the pieces of muscle.



The results are shown in the following table.

	Length of muscle			
Concentration of ATP solution (g per litre)	*At start* (mm)	*After 10 minutes* (mm)	*Decrease* (mm)	*Percentage decrease*
1	35	34·3	0.7	2
5	50	46	4	8
10	40	33	7	

(i) Calculate the percentage decrease in length of the muscle with 10 g per litre ATP solution.

Complete the table.

Space for calculation

1

(ii) In this experiment why is it necessary to use percentage decrease in length in the comparison of the results?

_____

_____ 1

DO NOT WRITE IN THIS MARGIN

Marks

7. (*a*) (continued)

(iii) Explain why three different syringes should be used in this investigation.

_____

_____ **1**

(*b*) Muscle cells use energy for contraction.

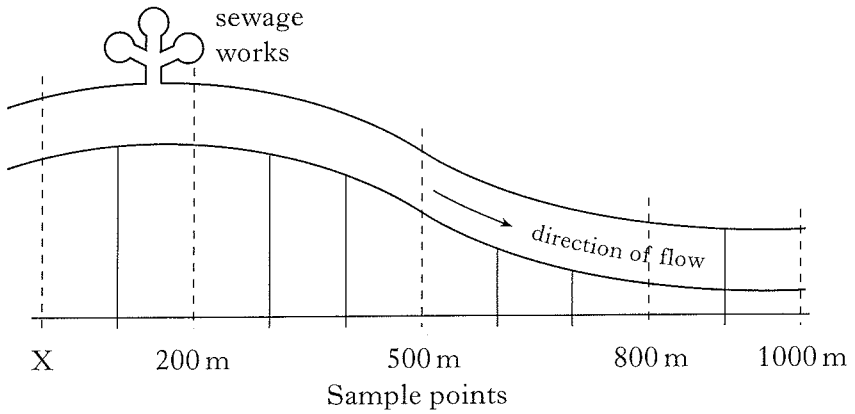
State **one** other cell activity that uses energy.

_____ **1**

[Turn over

Marks

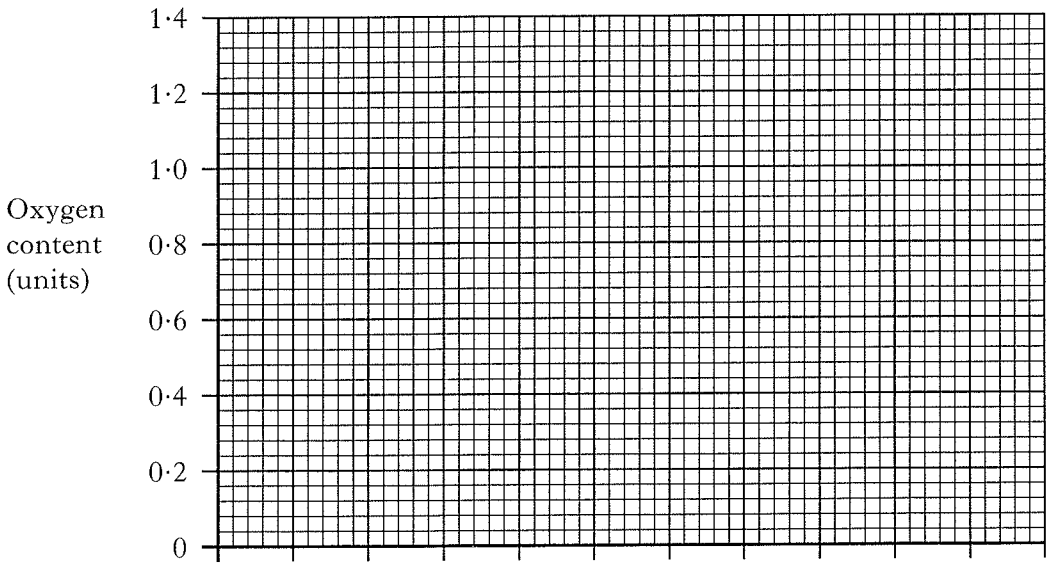
8. (*a*) The diagram below shows a section of a river.



The table below shows the results of a survey into the oxygen content of the river at different sample points.

Distance of sample point from X (m)	*Oxygen content* (units)
0	1·20
200	0·04
500	0·20
800	0·40
1000	1·00

(i) Construct a **line graph** of the results given in the table.
(Additional graph paper, if required, will be found on page 34)



2

DO NOT WRITE IN THIS MARGIN

Marks

8. (*a*) (continued)

(ii) From the table calculate how many times greater the oxygen content is at 0 m than at 200 m.

Space for calculation

_____ times **1**

(iii) Use data from the table to describe the relationship between oxygen content and distance of the sample point from X.

_____

_____

_____ **2**

(iv) The numbers of micro-organisms were counted at each sample point and found to be highest 200 m from X.

Account for the oxygen content of the river at 200 m.

_____

_____ **1**

(*b*) State the effect of an increase in pollution on species diversity.

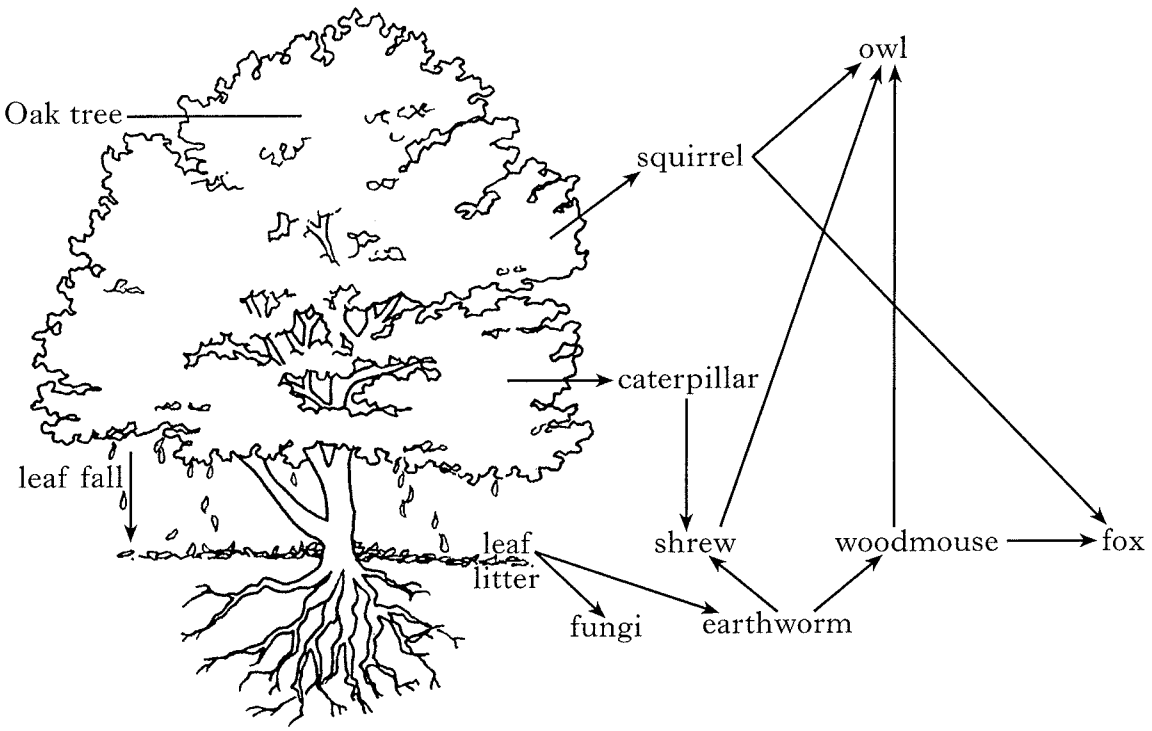
_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

9. (*a*) The diagram below shows part of a woodland food web.



(i) Complete the table below using named examples from the woodland food web.

Type of organism	*Named example*
Producer	
Predator	
Decomposer	
Herbivore	

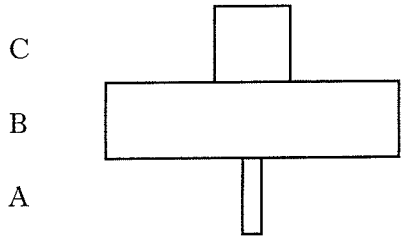
3

DO NOT WRITE IN THIS MARGIN

Marks

9. (*a*) (continued)

(ii) The diagram below shows a **pyramid of numbers** taken from the food web above. Suggest a food chain, from the woodland web, which would give this pyramid.



A _____ → B _____ → C _____ **1**

(iii) Draw and label the pyramid of **biomass** for the following food chain.

leaf litter → earthworm → woodmouse → fox

1

(*b*) State the term used to describe the role of an organism within an ecosystem.

_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

10. (*a*) Organisms vary from one generation to the next.
This variation may result from the following factors.

A Natural selection
B Selective breeding
C Environmental impact

Use this information to complete the table below.
(Each letter may be used once, more than once or not at all.)

Description	*Factor*
Produces changes not passed on to future generations	
Organisms that are better adapted to their surroundings survive and breed	
Effect of the surroundings on the final appearance of offspring	
Desirable characteristics chosen to produce improved offspring	

2

(*b*) Arrange the following stages of genetic engineering in the correct order.
The first stage has been given.

Stage number	*Description of stage*
1	Bacterial cell produces insulin
2	Insulin gene inserted into plasmid
3	Plasmid removed from bacterial cell
4	Plasmid inserted into bacterial cell
5	Insulin gene removed from human chromosome

Stage 5 → _____ → _____ → _____ → _____ 1

(*c*) Give **one** advantage of genetic engineering.

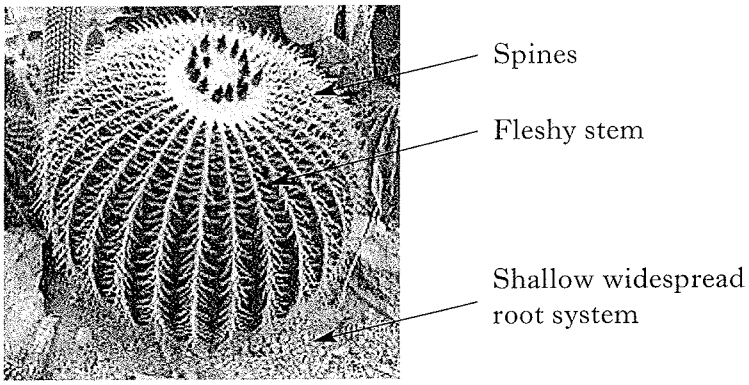
_____

_____ 1

Marks

10. (continued)

(*d*) The desert plant shown below has adaptations to survive in dry conditions.



From the diagram give **one** adaptation which reduces water loss.

_____ **1**

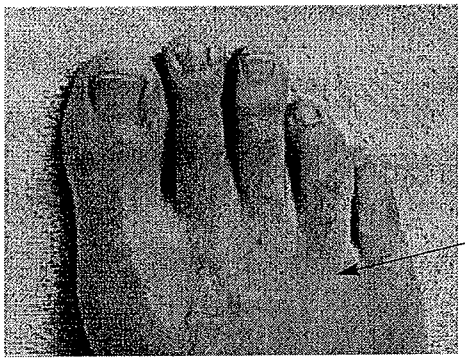
[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

11. In humans the length of the big toe is controlled by a single gene which has two alleles.

A father is homozygous for short big toe. A mother has long big toes. All of their children have short big toes.



(*a*) Complete the following sentences by **underlining** the correct word in each pair, using the information above.

{Long / Short} big toe is the dominant form of this gene. **1**

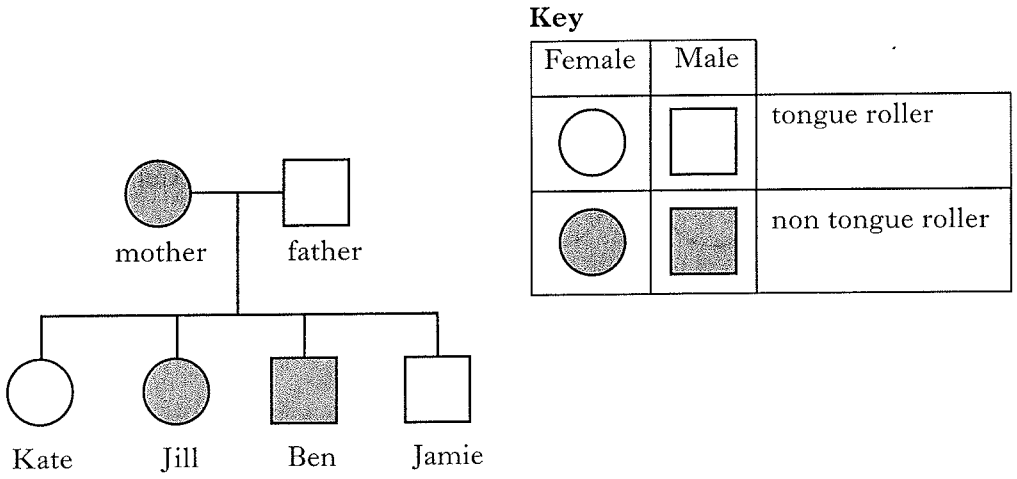
The mother is {homozygous / heterozygous} and the children are all {homozygous / heterozygous}. **1**

DO NOT WRITE IN THIS MARGIN

Marks

11. (continued)

(*b*) The ability to roll the tongue is controlled by another gene in humans. The allele for tongue rolling (R) is dominant to the allele for non tongue rolling (r). The diagram below shows the occurrence of this tongue rolling gene.



(i) With respect to the tongue rolling gene, state Jamie's phenotype and Ben's genotype.

Jamie's phenotype; _____ 1

Ben's genotype. _____ 1

(ii) Kate has a son and his father is homozygous dominant for the characteristic.

What is the percentage chance that the son is a tongue roller?

Space for working

_____% 1

(iii) State the two sex chromosomes present in Jill's body cells.

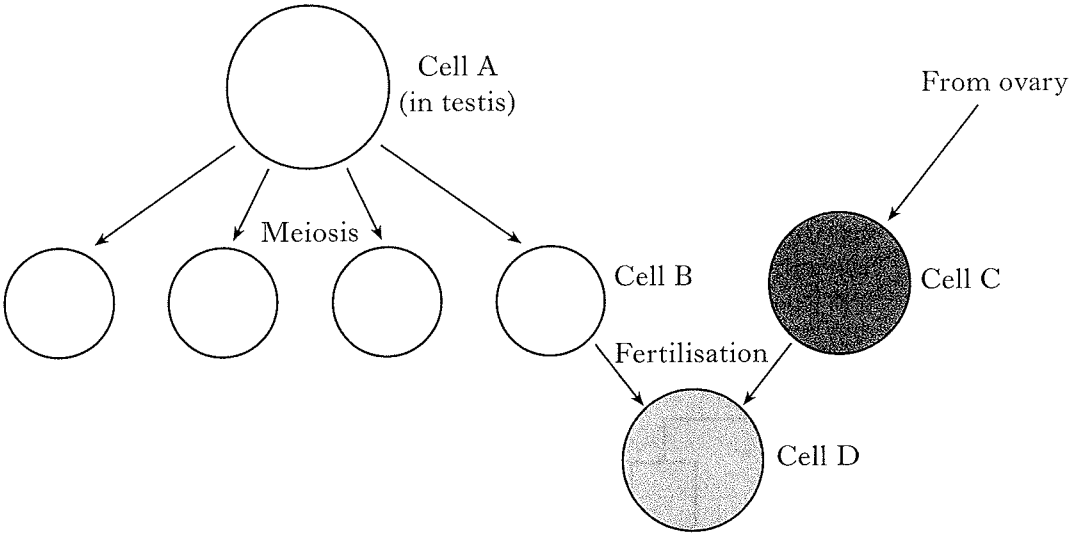
_____ 1

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

12. (*a*) The diagram below shows meiosis and fertilisation in humans.



(i) Complete the following table by naming the cells and stating the number of chromosomes present in each.

Cell	*Name of cell*	*Number of chromosomes*
A	testis cell	
B	sperm	
C		23
D		46

2

(ii) Describe what happens during fertilisation.

_____

_____ 1

(*b*) (i) Name a structure in a cell which is composed of a chain of DNA bases.

_____ 1

(ii) Explain the importance of the order of the DNA bases to the functioning of a cell.

_____

_____ 1

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SECTION C

Marks

Both questions in this section should be attempted.

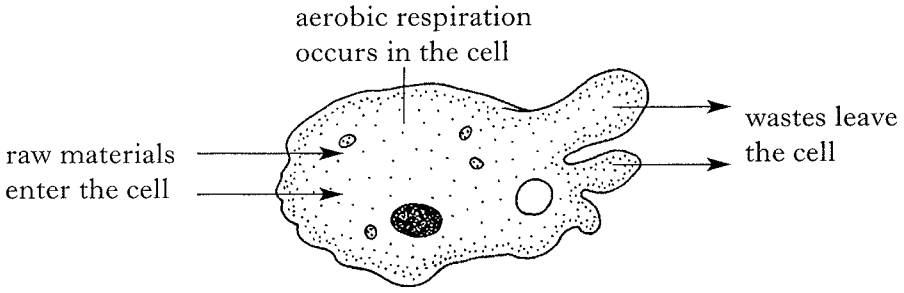
Note that each question contains a choice.

Questions 1 and 2 should be attempted on the blank pages which follow.
All answers must be written clearly and legibly in ink

Supplementary sheets, if required, may be obtained from the invigilator.

1. Answer **either** A **or** B.

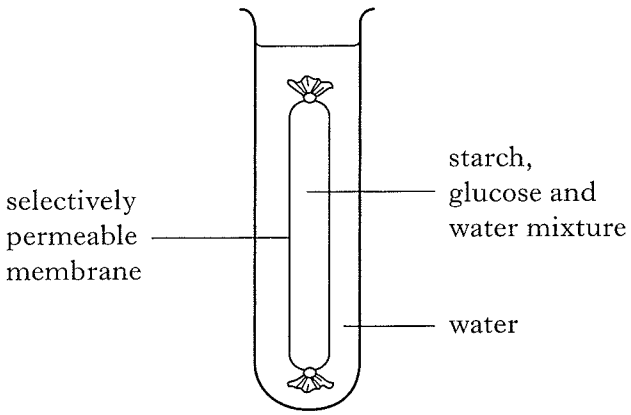
A. The diagram below represents an animal cell that is respiring aerobically.



Describe the **two** stages of aerobic respiration. Include the names of the raw materials and the products of the two stages. **5**

OR

B. The diagram below represents an experiment set up as shown then left for 1 hour.



Name and describe the **two** processes by which molecules would have moved. **5**

Question 2 is on *Page thirty-two*.

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Marks

2. Answer **either** A **or** B.

Labelled diagrams may be included where appropriate.

A. Describe the role of the small intestine in the digestion and absorption of food. **5**

OR

B. Describe the roles of the hypothalamus and ADH in the control of the water concentration of the blood. **5**

[END OF QUESTION PAPER]

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ADDITIONAL SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 8(*a*)(i)